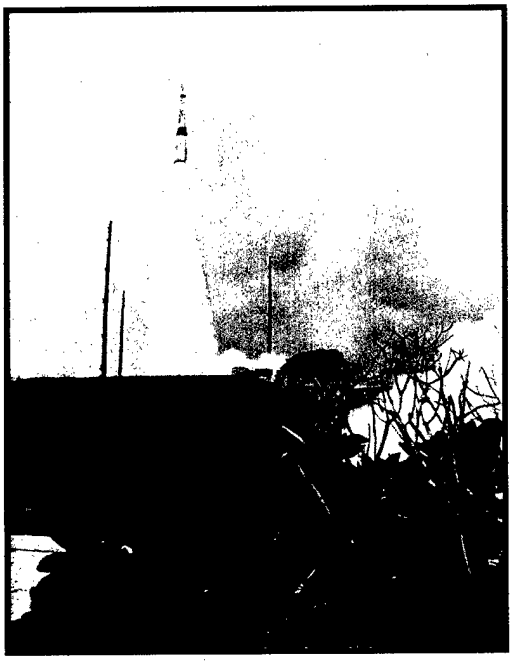
Ground-based Midcourse Defense Element Live Fire Test and Evaluation (LFT&E) Targets



Environmental Assessment

25 October 2001

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Environmental Division

To Whom It May Concern:

Please find the Ground-Based Midcourse Defense Element Live Fire Test and Evaluation Targets Environmental Assessment and its associated Draft Finding of No Significant Impact enclosed for your use and information.

Questions regarding this document or requests for additional copies should be addressed to: Deputy Commanding General, U.S. Army Space and Missile Defense Command, SMDC-EN-V-N, P.O. Box 1500, Huntsville, AL 35807-3801.

Sincerely,

Edwin P. Janasky
Colonel, U.S. Army
Deputy Chief of Staff
Engineer

Enclosure

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The Strategic Targets Project Office, within the Ballistic Missile Targets Joint Project Office of the U.S. Army Space and Missile Defense Command, proposes to use various configurations of a seedant (deuterium fluoride), high explosive, and sensor instrumentation payload package on several target missile launches from Vandenberg Air Force Base (AFB) to independently verify Ground-based Midcourse Defense Element interceptor effectiveness. The proposed action consists of three main activities. The first would be the transport of the seedant and payload to Vandenberg AFB. The second would be integration of the seedant into the target vehicle. The third activity would be flight testing with the seedant payload aboard the target vehicle. The interceptor missile would be launched from the U.S. Army Kwajalein Atoll/Ronald Reagan Ballistic Missile Test Site with intercept occurring over the Pacific Ocean.

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Introduction

The Department of Defense has designated the Ground-based Midcourse Defense Element (GMDE) (formerly National Missile Defense) as a major defense acquisition program. Every major defense acquisition program must include Live Fire Test and Evaluation (LFT&E) before proceeding with production of the missile system. LFT&E simulates the reality of wartime events more closely than laboratory testing. The requirement of LFT&E is the demonstration of system effectiveness against representative target missile payloads.

This Environmental Assessment provides analysis to support Federal decisions relating to the use of an additional target missile payload at Vandenberg Air Force Base (AFB), California to support GMDE testing. The payload would be composed of a seedant compound (a material intentionally placed on a target to enhance post-test analysis), high explosive (HE) material, and various supporting sensor and instrumentation equipment contained within the reentry vehicle (RV). As currently planned, various configurations of the payload would be flown on the target missile in six to seven integrated flight tests. The number and design of tests and the configuration of test payloads could change with changes to the GMDE program and its flight test plan. The target missile would be launched from Vandenberg AFB, and the interceptor missile would be launched from Meck Island in the U.S. Army Kwajalein Atoll. Intercept would occur over the Broad Ocean Area of the Pacific Ocean.

Although the target RV would include sensors and telemetry devices to monitor and transmit impact response data, the high engagement velocities make the sensor-to-telemetry timeline so short that the timing of telemetered data must be nearly perfect under the most ideal engagement conditions. As currently configured, seedant and HE are needed on the target RV during flight testing to supplement lethality analysis provided through telemetered data. In the event of limited or insufficient telemetry data, use of the seedant may provide the only confirmation of interceptor effectiveness.

Program Activities

The Proposed Action consists of three main activities. The first would be the transport of the seedant and payload to Vandenberg AFB. The second would be integration of the seedant into the target vehicle. The third activity would be flight testing with the seedant payload aboard the target vehicle. Deuterium fluoride (DF) is the seedant proposed for use.

It is currently anticipated that up to 44 kilograms (100 pounds) of an HE compound and 2 kilograms (4 pounds) (2 liters [0.5 gallon]) of DF would be contained within the target vehicle, depending on particular integrated flight test requirements. The HE would detonate upon interceptor impact and excite the DF seedant, which would allow for infrared detection and observation by sensor equipment.

It is currently planned for the DF seedant and seedant-filling equipment to be shipped directly to Vandenberg AFB from the manufacturer by commercial carrier. Only enough seedant for two missile flights would be shipped to Vandenberg AFB at one time. The RV and HE payload would be transported to Vandenberg AFB from Lawrence Livermore National Laboratory/Sandia National Laboratories facilities and stored in an approved facility at Vandenberg AFB until integrated into the target missile.

When all the component parts have been received at Vandenberg AFB, final assembly and loading of the missile would occur to prepare the missile for launch. The seedant vessel would be filled with DF before launch. This operation would occur in Missile Assembly Building 1819, but could be performed on the launch pad, if necessary. The seedant would be pumped into the vessel through low-pressure pumps, and the vessel would be sealed for launch. All seedant loading procedures would be reviewed and approved by the Vandenberg AFB Safety Office before filling operations occur.

Once the missile has been loaded and the systems have been checked during preflight testing and operations, the target vehicle would be launched from Launch Facility-06 or -03 (backup site), on its trajectory over the Pacific Ocean. At a predetermined time, an interceptor missile would be launched from U.S. Army Kwajalein Atoll/Ronald Reagan Ballistic Missile Test Site to attempt an exo-atmospheric intercept of the target. The seedant would be excited by the energy resulting from the high-velocity impact and would be released into the vacuum of space upon vessel rupture. The infrared emission and/or absorption of the DF would be recorded by instrumentation aboard a High Altitude Observatory aircraft, which would monitor the intercept area from a distance of about 900 kilometers (560 miles).

If the interceptor fails to hit the target, the RV would continue on a ballistic trajectory and fall into the Pacific Broad Ocean Area. The seedant material would either be vaporized with HE detonation upon impact, or the RV and seedant vessel would rupture upon impact and the seedant would be dispersed into the ocean.

In the event of a launch abort, the seedant would be removed from its holding vessel on the target vehicle according to pre-developed removal procedures, would be recovered for use in other tests, and stored in commercial containers at Vandenberg AFB in an approved facility. Seedant removal would be performed only if the mission is aborted or if the launch is delayed for more than 1 year.

Alternatives considered include using hydrogen fluoride instead of DF, using a mixture of seedants, and omitting the HE. The chemical properties and environmental and safety hazards of hydrogen fluoride and DF are equivalent. It is possible that a program management decision could be made that would require several different seedants at different locations in the target instead of DF alone. This would necessitate the drafting and approval of a unique filling operation, with fill system hardware changes. The chemicals would be transported in separate containers. It is currently planned for HE to be included in the RV payload. However, a program management decision could be made to eliminate the HE. With no HE in the payload, additional DF seedant (up to 10 liters [2.6

gallons]) would be necessary to improve the probability of detection. The No-action Alternative was also considered.

Methodology

To assess the significance of any impact, a list of activities necessary to accomplish the Proposed Action was developed. The affected environment at all applicable locations was then described. Next, those activities with the potential for significant environmental consequences were identified. If a proposed activity was determined to have a potential for causing significant environmental impact, it was analyzed in greater detail in terms of intensity, extent, and context in which significant impacts would occur. The significance criteria used to evaluate the environmental effects of program activities include three levels of impacts: no impacts, no significant impact, and significant impact.

Fourteen broad environmental components were originally considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the severity of potential impacts. These areas of environmental consideration were air quality, airspace, biological resources, cultural resources, environmental justice, geology and soils, hazardous materials and waste, health and safety, infrastructure, land use, noise, socioeconomics, visual and aesthetics resources, and water resources. Ten of the areas—airspace, cultural resources, environmental justice, geology and soils, infrastructure, land use, noise, socioeconomics, visual and aesthetics resources, and water resources—were not further analyzed for any of the proposed locations.

No new impacts to airspace or new sources of noise are anticipated. No impacts are anticipated to cultural resources, geology and soils, or water resources since no ground-disturbing activities are planned. No adverse impacts to minority or low-income communities (Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*) are anticipated. Existing infrastructure would be used, and no change is anticipated to current land use or to the visual and aesthetic environment of the proposed locations. Personnel would be drawn from the existing workforce, thus minimizing the beneficial impacts to socioeconomics in the affected regions.

Results

The LFT&E program has the potential to result in impacts to air quality, biological resources, hazardous materials and waste, and health and safety. The potential impacts to these resources are discussed below. Within each resource summary, only those activities for which a potential environmental concern was determined are described.

Proposed Action

Air Quality

A successful flight test using DF seedant and HE would have a negligible impact on air quality. All emissions would be regulated in accordance with the Memorandum of Agreement between Vandenberg AFB and the Santa Barbara County Air Pollution Control District. In the case of a ground-level accident, levels of emissions from the kill vehicle

and payload would not exceed current air standards due to the small amount of seedant in the payload. DF released at the anticipated intercept altitude (200 to 250 kilometers [124 to 155 miles]) would slowly dissociate, but the fluorine does not cause ozone depletion.

Biological Resources

No construction would be required, thus there would be no ground disturbance and resultant impact to vegetation. Implementation of applicable safety regulations would minimize the potential for adverse impacts to vegetation from accidental spills or releases of DF and HE.

Applicable safety regulations that would minimize the potential for accidental release would be followed. No impacts are anticipated to wildlife from accidental release of DF during filling operations since the amount would be limited to a few ounces, which would be contained or dispersed prior to reaching wildlife habitat.

Intercept would occur over the Pacific Ocean at an altitude of 200 to 250 kilometers (124 to 155 miles). The seedant released at this altitude would slowly dissociate and would not increase the potential for adverse impacts to marine species. In the case of a missed intercept, the RV would continue on a ballistic trajectory and fall into the ocean. The seedant material would either be vaporized with HE detonation upon impact or dispersed into the ocean. The small amount that could be dispersed is expected to result in a negligible increase in the potential for impact to marine species that could be within the area.

Hazardous Material and Waste

LFT&E launch operations would involve hazardous materials similar to those currently used on Vandenberg AFB. Hazardous waste would be containerized and disposed of or recycled in accordance with Vandenberg AFB procedures. Only enough seedant for two missile flights (4 liters [1 gallon]) would be shipped to Vandenberg AFB at one time. The seedant plus 11 to 44 kilograms (25 to 100 pounds) of HE would be stored in their original shipping containers in an approved storage facility. This amount of DF and HE would be a negligible increase in the total amount of hazardous material commonly located on Vandenberg AFB. All applicable safety regulations would be followed and no hazardous material and waste impacts are expected.

Health and Safety

All applicable safety regulations and requirements would be followed which would minimize the potential for accidents, as well as provide the means to mitigate effects if an accident were to occur. All seedant-loading procedures would be reviewed and approved by the Vandenberg AFB Safety Office prior to filling operations. The usual precautionary measures for handling chemicals would be followed. All personnel involved in filling operations would wear appropriate protective clothing including impervious gloves, suitable respirators, and eye protection and would be trained in the correct procedures for handling DF and HE. No impacts to health and safety are anticipated.

Alternatives

Since the chemical properties and environmental and safety hazards of HF and DF are equivalent, the impacts from the use of HF would be the same. The addition of hydrogen chloride to the target payload would not result in a substantial increase in the impacts previously analyzed for solid propellant missiles. Hydrogen bromide would present potential hazards similar to hydrogen chloride. Deuterium oxide and monodeuterated water pose little risk of releasing hazardous substances into the environment. They are not radioactive or dangerous to humans or other life in the quantities that would be required for the LFT&E program. Due to the difference in characteristics such as vapor pressure and corrosion, unique filling operations would be written and approved if and when alternative seedants are selected. Adding up to 10 liters (2.6 gallons) of DF while eliminating the 44 kilograms (100 pounds) of HE would not result in a substantial increase in impacts.

If the No-action Alternative is selected, no environmental consequences associated with the LFT&E program are anticipated. Vandenberg AFB would continue to launch target missiles as analyzed in prior environmental documentation.

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ACRONYMS AND ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS

30 CES/CEVPN	Civil Engineering Squadron/Environmental Management
30 CES/CEX	Readiness Flight
30 SW/SE	Space Wing/Safety Office
AFB	Air Force Base
BMTJPO	Ballistic Missile Targets Joint Project Office
DF	deuterium fluoride
D_2O	deuterium oxide
DOD	Department of Defense
EA	Environmental Assessment
GMDE	Ground-based Midcourse Defense Element
HBr	hydrogen bromide
HCl	hydrogen chloride
HDO	monodeuterated water
HE	high explosive
HF	hydrogen fluoride
IFT	Integrated Flight Test
LF	Launch Facility
LFT&E	Live Fire Test and Evaluation
MAB	missile assembly building
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
PM-10	particulate matter less than 10 microns in diameter
ppm	parts per million
RDX	cyclotrimethylenetrinitramine (Rapid Detonating Explosive)
ROI	region of influence
RV	reentry vehicle
STPO	Strategic Targets Product Office
TNT	trinitrotoluene
U.S. DOT	United States Department of Transportation

U.S. EPA	United States Environmental Protection Agency
USAKA/RTS	United States Army Kwajalein Atoll/Ronald Reagan Ballistic Missile Test Site
USFWS	United States Fish and Wildlife Service

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1.0
PURPOSE AND NEED

1.0 PURPOSE AND NEED

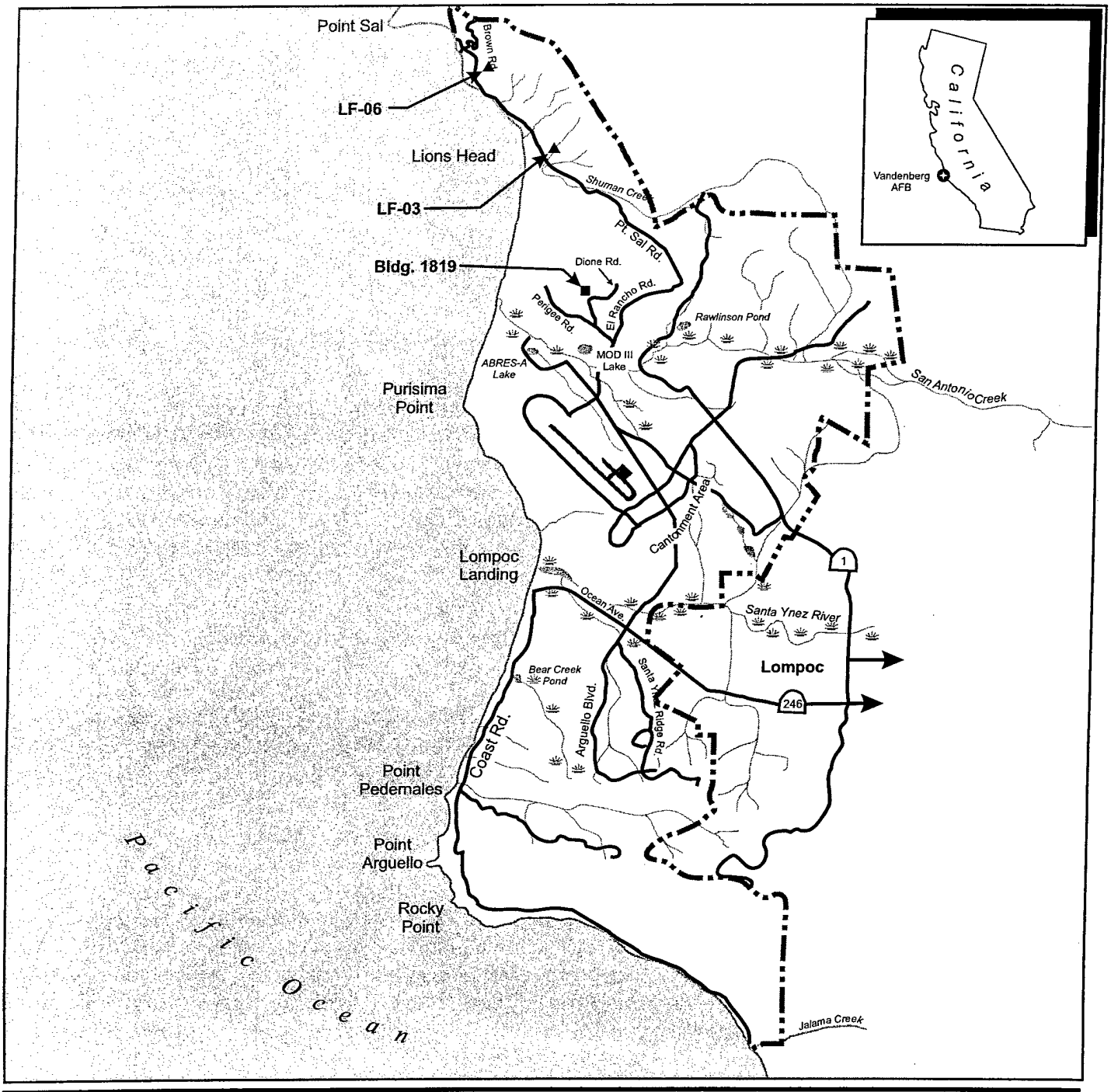
1.1 BACKGROUND

The proliferation of weapons of mass destruction and the technology of long-range missiles are increasing the threat to our national security. The purpose of the Ground-based Midcourse Defense Element (GMDE) (formerly known as National Missile Defense) of the Missile Defense System program is to defend the United States (all 50 states) against the threat of a limited strategic ballistic missile attack from a nation of concern.

The National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321, et seq.), the Council on Environmental Quality regulations implementing NEPA (40 Code of Federal Regulations 1500-1508), Department of Defense (DoD) Instruction 4715.9, *Environmental Planning and Analysis*, and the applicable service environmental regulations that implement these laws and regulations direct DoD lead agency officials to consider potential environmental impacts and consequences when authorizing or approving Federal actions.

The DoD has designated the GMDE system as a major defense acquisition program. Every major defense acquisition program must include Live Fire Test and Evaluation (LFT&E) before proceeding with production of the missile system. LFT&E simulates the reality of wartime events more closely than laboratory testing. The requirement of LFT&E is the demonstration of system effectiveness against representative target missile payloads. The LFT&E would assist in assessing the operational realism of the GMDE.

This Environmental Assessment (EA) provides analysis to support Federal decisions relating to the use of an additional target missile payload at Vandenberg Air Force Base (AFB), California (figure 1-1) to support GMDE testing. The payload would be composed of a seedant compound (a material intentionally placed on a target to enhance post-test analysis), high explosive (HE) material, and various supporting sensor and instrumentation equipment contained within the reentry vehicle (RV). As currently planned, various configurations of the payload would be flown on the target missile in six to seven GMDE integrated flight tests (IFTs). These flights are referred to as IFT 8, 9, 10, 13, 14, 16, and 17. IFT 8 would only contain sensor and instrumentation equipment, and an inert mass substitute for the seedant and HE. Seedant is currently planned for use on up to three technology risk reduction flights (IFTs 9 and 10 [IFT 13 backup]), scheduled to begin in the third quarter of fiscal year 2002. IFTs 10 and 13 would also contain HE. The entire payload package would be flown subsequently on three additional LFT&E flights (IFTs 14, 16, and 17), which are currently scheduled to begin in the first quarter of fiscal year 2004. The number and design of tests and the configuration of test payloads could change with changes to the GMDE program and its flight test plan. The target missile would be launched from Vandenberg AFB, and the interceptor missile would be launched from the U.S. Army Kwajalein Atoll/Ronald Reagan Ballistic Missile Test Site (USAKA/RTS). Intercept would occur over the Broad Ocean Area of the Pacific Ocean (figure 1-2).



EXPLANATION

- Land Area
- Water Area
- Vandenberg AFB Boundary
- Road
- River / Creek
- Wetlands

NORTH

Scale

0 3.42 6.84 kilometers

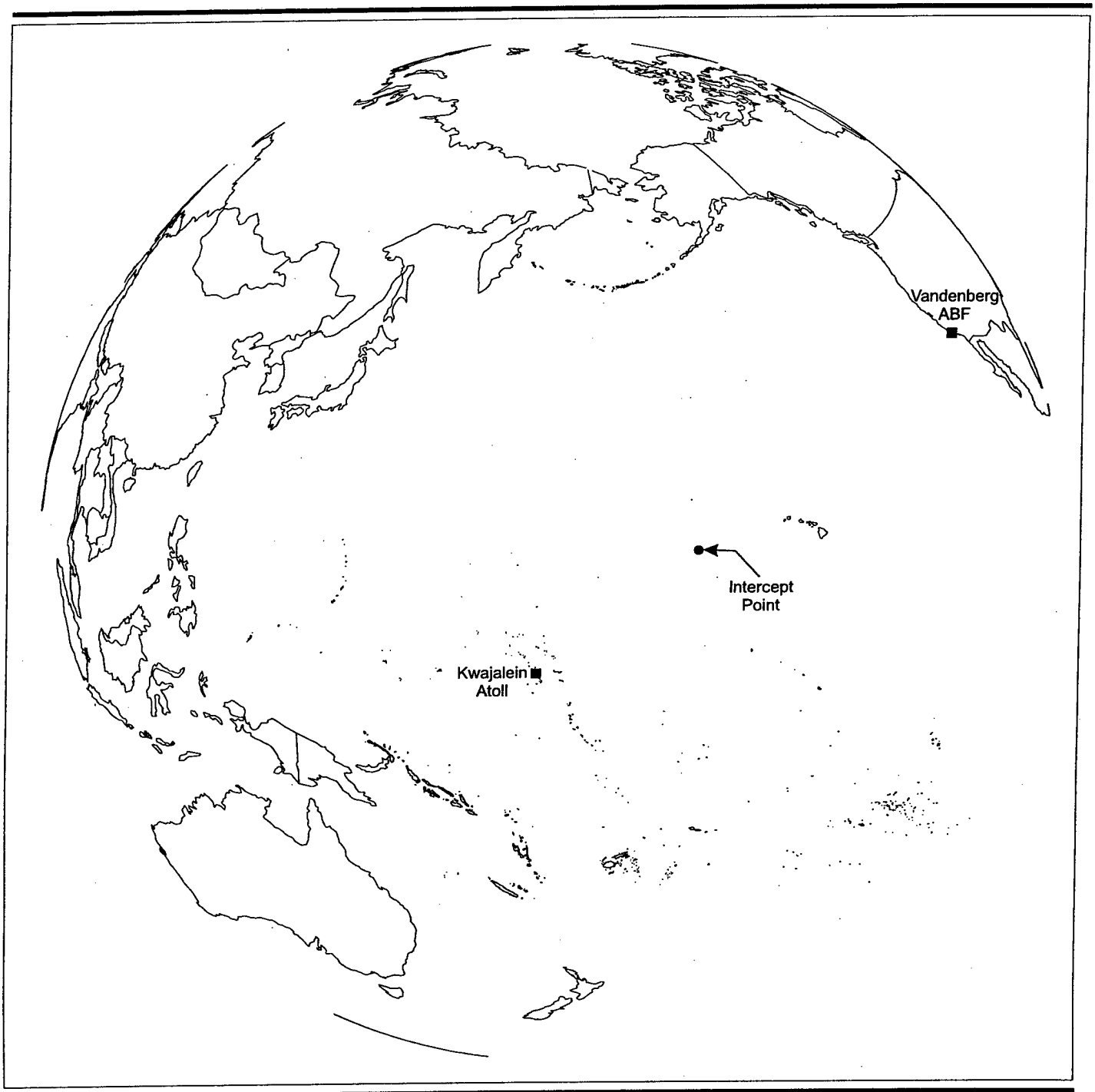
0 2.13 4.25 miles

10-23-01 Vandenberg AFB 01

Vandenberg Air Force Base and Project Location Map

California

Figure 1-1



EXPLANATION

Notional Intercept Location

Pacific Ocean

Scale
0 915.5 1831 kilometers
0 569 1138 miles

NORTH

10-23-01 Global Intercept Point

Figure 1-2

The Ballistic Missile Targets Joint Project Office (BMTJPO) Strategic Targets Product Office (STPO) is responsible for the development of the target RV and target vehicle payload. STPO has in turn tasked Sandia National Laboratories in Albuquerque, New Mexico, with the design and construction of the RV and Lawrence Livermore National Laboratory in Livermore, California, with the design and construction of the payload. The payload, which is a subcomponent of the RV, would contain the seedant vessel.

1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.2.1 PURPOSE AND NEED

The purpose of the Proposed Action is to support GMDE interceptor flight testing. Although the target RV would include sensors and telemetry devices to monitor and transmit impact response data, the high engagement velocities make the sensor-to-telemetry timeline so short that the timing of telemetered data must be nearly perfect under the most ideal engagement conditions. As currently configured, seedant and HE are needed on the target RV during flight testing to supplement lethality analysis provided through telemetered data. In the event of limited or insufficient telemetry data, use of the seedant may provide the only confirmation of interceptor effectiveness.

1.2.2 DECISION TO BE MADE

The BMTJPO STPO is the proponent for the action. The Director, Ballistic Missile Defense Organization, would decide whether to implement the Proposed Action of using a seedant payload package on selected IFT target RVs to verify the intercept lethality of the system.

1.3 SCOPE OF ENVIRONMENTAL ASSESSMENT

This EA evaluates the potential environmental impacts of including an additional missile payload on test targets to be launched from Vandenberg AFB, particularly the potential effects of dispersing seedant. It also evaluates related activities, such as safety issues associated with transporting and handling seedant and HE that could have potential impacts on public health and safety or the environment.

This analysis is tiered from the *Ballistic Missile Defense Final Programmatic Environmental Impact Statement* (Ballistic Missile Defense Organization, 1994), which evaluated GMDE programmatic activities, such as research and development, testing, production, and the general operational concept. This EA does not specifically address missile launches from either USAKA/RTS or Vandenberg AFB. Missile launches have been addressed in prior environmental documents such as those listed below.

1.3.1 RELATED ENVIRONMENTAL DOCUMENTATION

Previous NEPA documentation prepared for interceptor launches from USAKA/RTS, target launches from Vandenberg AFB, and related test activities includes:

U.S. Air Force, 1976. *Environmental Assessment for Minuteman & Thor Missile Launches at Vandenberg Air Force Base, California*, 16 April.

U.S. Air Force, 1999. *Booster Verification Tests Environmental Assessment, Vandenberg Air Force Base, California*, March.

U.S. Army Space and Missile Defense Command, 1999. *Record of Environmental Consideration for Infrastructure Modernization and Test Facilities Construction in Support of National Missile Defense Ground Based Interceptor Booster Verification/Integrated Flight Tests at Meck Island, U.S. Army Kwajalein Atoll/Kwajalein Missile Range, Republic of the Marshall Islands*, February.

U.S. Army Space and Strategic Defense Command, 1993. *Final Supplemental Environmental Impact Statement for Proposed Actions at U.S. Army Kwajalein Atoll*, December.

U.S. Department of the Air Force, 1997. *Theater Ballistic Missile Targets Programmatic Environmental Assessment, Vandenberg Air Force, California,* December.

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2.0
DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The BMTJPO STPO proposes to use various configurations of a seedant, HE, and sensor instrumentation payload package on several target missile launches from Vandenberg AFB to independently verify GMDE interceptor effectiveness. The Proposed Action consists of three main activities. The first would be the transport of the payload components to Vandenberg AFB. The second would be integration of the seedant into the target vehicle. The third activity would be flight testing with the integrated payload aboard the target vehicle. The seedant and HE are described along with the proposed project activities in the following sections.

2.1 DESCRIPTION OF SEEDANT AND HIGH EXPLOSIVE

2.1.1 SEEDANT

Deuterium fluoride (DF) is not found in substantial quantities readily in nature. It is a toxic, corrosive, non-flammable liquefied gas packaged in cylinders under its own vapor pressure of 14.1 pounds per square inch at 70°F. The gas is colorless, but generates white fumes in moist air, depending on relative humidity. Reaction with water will produce heat and hydrofluoric acid. Though inhalation of fumes can lead to inflammation and congestion of the lungs, and circulatory collapse, DF has a repulsive, irritating, acidic odor that is easily detected at low concentrations. Direct skin contact can cause severe burns that may not be immediately painful or visible. The Occupational Safety and Health Administration's permissible exposure limit is 3 parts per million (ppm). It is currently anticipated that approximately 2 liters (0.5 gallon) of DF would be used as a seedant on selected IFT target vehicles.

2.1.2 HIGH EXPLOSIVE

It is currently anticipated that up to 44 kilograms (100 pounds) of an HE compound, commonly referred to as Composition-B (or Comp-B), would be contained within the payload, depending on particular IFT requirements. Comp-B consists of cyclotrimethylenetrinitramine (RDX) and trinitrotoluene (TNT). This mixture would detonate upon interceptor impact and excite the DF seedant, which would allow for infrared detection and observation by sensor equipment. Comp-B components would be purchased commercially, and the HE would be fabricated at Lawrence Livermore National Laboratory Site 300, Los Alamos National laboratory, or in Arkansas at Primex Technologies, Inc. The HE would then be integrated into the payload at Sandia National Laboratories or Lawrence Livermore National Laboratory facilities. Fabrication and payload integration of the HE

would be routine activities for these locations and would not create additional personnel or infrastructure demands.

2.2 PAYLOAD COMPONENT TRANSPORTATION TO VANDENBERG AFB

It is currently planned for the DF seedant to be shipped directly to Vandenberg AFB from the manufacturer by commercial carrier. Only enough seedant for two missile flights would be shipped to Vandenberg AFB at a time.

The RV and payload with HE would be transported to Vandenberg AFB from Lawrence Livermore National Laboratory/Sandia National Laboratories facilities by the Department of Energy Safe Secure Transport or by commercial carrier. The RV and payload would be stored in an approved facility at Vandenberg AFB until integrated into the target missile. Seedant filling equipment would be transported by commercial carrier to Missile Assembly Building (MAB) 1819.

All transportation of the seedant and HE within the continental United States would be performed in accordance with U.S. Department of Transportation (U.S. DOT) and U.S. Army approved explosive safety and hazardous material regulations and routing. The seedant and HE would be transported in U.S. DOT-approved shipping containers. Appropriate safety measures would be followed during transportation of the seedant and HE as required by U.S. DOT and as described in the Bureau of Explosives Tariff No. BOE 6000-I, *Hazardous Materials Regulations of the Department of Transportation*. For aircraft transportation, Federal Aviation Administration and/or applicable U.S. Air Force safety regulations would be followed.

2.3 SEEDANT INTEGRATION

When all the component parts have been received at Vandenberg AFB, final assembly and loading of the missile would occur to prepare the missile for launch. Operations would take place in MAB 1819, which has a 9-metric ton (10-ton) overhead bridge crane, a forklift, a nitrogen tank charging system, certified facility grounding, office areas, a payload processing area, a security fence completely surrounding its perimeter, and limited ordnance and chemical storage. All ordnance would be handled in accordance with standard safety procedures.

The seedant vessel would be filled with DF before launch. This operation would normally occur in MAB 1819, but could be performed on the launch pad, if necessary. The seedant would be pumped into the vessel through low-pressure pumps in a closed system (i.e., no loss to atmosphere), and the vessel would be sealed for launch. Operational details of the procedure are described in the seedant pumping system operational safety procedures, developed by Lawrence Livermore National Laboratory. All seedant-loading procedures would be reviewed and approved by the Vandenberg AFB Safety Office before filling

operations, and would involve two or three persons from Lawrence Livermore National Laboratory. The seedant vessel is designed for long-term integrity, and can hold seedant for up to 1 year, if necessary.

All personnel involved in seedant filling operations would wear appropriate protective clothing, as described in the DF Material Safety Data Sheet in appendix B. This would include rubber or neoprene gloves, chemical goggles or a faceshield, acid-resistant coat/coveralls, and, if required, respiratory protection. All personnel would adhere to proper chemical handling and emergency procedures.

2.4 FLIGHT TESTING WITH SEEDANT

Once the missile has been loaded and the systems have been checked during preflight testing and operations, the target vehicle would be launched from Launch Facility (LF)-06 or LF-03 (backup site), on its trajectory over the Pacific Ocean (figure 1-1). At a predetermined time, an interceptor missile would be launched from U.S. Army Kwajalein Atoll and attempt an exo-atmospheric intercept of the target. The seedant would be excited by the energy resulting from the high-velocity impact and would be released into the vacuum of space upon vessel rupture. The infrared emission and/or absorption of the DF would be recorded by instrumentation aboard a High Altitude Observatory aircraft, which would monitor the intercept area from a distance of about 900 kilometers (560 miles).

If the interceptor fails to hit the target, the RV would continue on a ballistic trajectory and fall into the Pacific Broad Ocean Area. The seedant material would either be vaporized with HE detonation upon impact, or the RV and seedant vessel would rupture upon impact and the seedant would be dispersed into the ocean.

In the event of a launch abort, the seedant would be removed from its holding vessel on the target vehicle according to removal procedures pre-developed by Lawrence Livermore National Laboratory, and would be recovered for use in other tests. The seedant would be stored in commercial containers at Vandenberg AFB in an approved facility. Seedant removal would be performed only if the mission is aborted or if the launch is delayed for more than one year.

As described in section 1.1, various configurations of the payload would be flown on the target missile for six to seven IFTs. IFT 8 would only contain sensor and instrumentation equipment, and an inert mass substitute for the seedant and HE. The IFT 9 would contain sensor equipment and seedant but no HE. IFT 10 (and 13, if necessary) would contain the sensors, seedant, and HE. The LFT&E IFTs 14, 16, and 17 would also contain the entire payload package.

2.5 ALTERNATIVES CONSIDERED

2.5.1 HYDROGEN FLUORIDE SEEDANT

Hydrogen fluoride (HF) is the only other seedant candidate under consideration at this time, given the test requirements and budgetary constraints. The chemical properties and environmental and safety hazards of HF and DF are equivalent because they are isomers. Filling and removal procedures would be identical to those specified for DF. While the use of an alternative seedant may be considered, the spectral properties of the alternative may make it physically infeasible or may necessitate additional and costly instrumentation to assure a high probability of seedant observation.

2.5.2 CHEMICAL MIXTURE SEEDANT

It is possible that a program management decision could be made that would require several different seedants (identified in section 2.6) at different locations in the target instead of DF alone. This would necessitate the drafting and approval of a unique filling operation, with fill system hardware changes. The chemicals would be transported in separate containers.

2.5.3 OMIT HIGH EXPLOSIVE

It is currently planned for HE to be included in the RV payload as described in previous sections. However, a program management decision could be made to eliminate the HE. With no HE in the payload, additional DF seedant (up to 10 liters [2.6 gallons]) would be necessary to improve the probability of detection.

2.5.4 NO ACTION

Under the No-action Alternative, BMTJPO STPO would not proceed with using a seedant payload package on IFTs to independently verify interceptor effectiveness. Selection of the No-action Alternative would negatively affect the reliability of the NMD program in that the ability of the interceptor to render a hostile missile payload ineffective may not be fully determined.

2.6 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

To meet the prescribed mission requirements, the selected chemical seedant must have a unique fingerprint in the infrared spectrum. Over 20 chemicals were initially examined for the following characteristics:

- Desired spectral properties, both intrinsic features such as line strength and distinctive features, and extrinsic features such as having lines located in spectral regions expected to be free of interference
- Chemical and physical stability
- Safety
- Ease of handling

Original primary seedant candidates included DF, HF, hydrogen chloride—isotope 35 (^{35}HCl), hydrogen chloride—isotope 37 (^{37}HCl), monodeuterated water (HDO), deuterium oxide (D_2O, or "heavy water"), and hydrogen bromide (HBr). These candidates were selected from the initial group based on the analysis of spectral, physical, and chemical properties. By a wide margin, the best choices for infrared observation were DF and HF; subsequently, DF emerged as the highest priority chemical.

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3.0
AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

This section describes the environmental characteristics that may be affected by the Proposed Action at Vandenberg AFB. To provide a baseline point of reference for understanding any potential impacts, the affected environment is concisely described; any components of greater concern are described in greater detail. The EA evaluates the potential environmental impacts of including an additional payload on test target missiles launched from Vandenberg AFB, particularly the potential impacts of the dispersal of seedant material. The EA also evaluates related activities, such as safety issues associated with transporting and handling seedant and HE materials, which could have potential impacts on public health and safety or the environment.

Available reference materials, including EAs, Environmental Impact Statements, and base master plans, were reviewed. Questions were directed to installation and facility personnel, and private individuals. Site visits were also conducted where necessary to gather the baseline data presented below.

Environmental Resources

Fourteen broad areas of environmental consideration were originally considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the severity of potential impacts. These areas included air quality, airspace, biological resources, cultural resources, environmental justice, geology and soils, hazardous materials and waste, health and safety, infrastructure, land use, noise, socioeconomics, visual and aesthetic resources, and water resources. Ten of the areas—airspace, cultural resources, environmental justice, geology and soils, infrastructure, land use, noise, socioeconomics, visual and aesthetics resources, and water resources—were not further analyzed for any of the proposed locations.

No new impacts to airspace or new sources of noise are anticipated. No impacts are anticipated to cultural resources, geology and soils, or water resources since no ground-disturbing activities are planned. No adverse impacts to minority or low-income communities (Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*) are anticipated. Existing infrastructure would be used, and no change is anticipated in current land use or to the visual and aesthetic environment of the proposed locations. Personnel would be drawn from the existing workforce; thus minimizing beneficial impacts to socioeconomics in the affected regions.

The LFT&E program has the potential to result in impacts to air quality, biological resources, hazardous materials and waste, and health and safety. The potential impacts to these resources are discussed below.

Environmental Setting

Vandenberg AFB is located 88 kilometers (55 miles) north of Santa Barbara near Lompoc, California. The cities nearest to the base are Lompoc, 11 kilometers (7 miles) southeast, and Santa Maria, 27 kilometers (17 miles) northeast. The 399-square kilometer (154-square mile) base covers more than 396,606 hectares (98,000 acres) along 56 kilometers (35 miles) of undeveloped Pacific coastline. Vandenberg AFB's climate is Mediterranean, or dry summer subtropical.

3.1 AIR QUALITY

Air quality in a given location is described by the concentrations of various pollutants in the atmosphere, expressed in units of ppm or micrograms per cubic meter. Pollutant concentrations are determined by the type and amount of pollutants emitted into the atmosphere; the physical characteristics, including size and topography, of the air basin; and meteorological conditions related to prevailing climate. The significance of a pollutant concentration is determined by comparison with National Ambient Air Quality Standards (NAAQS) and local ambient air standards that establish limits on the maximum allowable concentrations of various pollutants to protect public health and welfare.

Region of Influence

For inert pollutants (all pollutants other than ozone and its precursors, nitrogen oxide and reactive organic compounds), the region of influence (ROI) is generally limited to an area extending no more than a few tens of miles downwind from the source. Since the project area has no heavy industry and very few automobiles, tropospheric ozone and its precursors are not of concern. Consequently, for the air quality analysis, the ROI for project operational activities is a circular area with a radius of only several hundred feet centered on the site of activity.

Affected Environment

An air basin is an area of the state, often comprising several counties, which has been designated as such by the California Air Resources Board based upon similar meteorological and geographic conditions. Vandenberg AFB is located in the South Central Coast Air Basin, which consists of San Luis Obispo, Santa Barbara, and Ventura counties (California Air Resources Board, 2000). With respect to air quality, Santa Barbara County is divided into North County and South County. Vandenberg AFB is located within North County (U.S. Department of the Air Force, 1995).

The State of California has adopted ambient air quality standards that either meet or exceed the NAAQS. The California Ambient Air Quality Standards are more strict than the NAAQS for ozone, carbon monoxide, sulfur dioxide, particulate matter less than 10 microns in diameter (PM-10), and lead, and in addition to the six criteria pollutants covered by the NAAQS, also contain standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility.

According to U.S. Environmental Protection Agency (U.S. EPA) guidelines, areas with air quality surpassing the NAAQS are designated as being in attainment; areas with a lesser air quality are classified as non-attainment areas. Santa Barbara County is in attainment for all Federal standards except ozone and in state non-attainment for both ozone and PM-10. (Santa Barbara County Air Pollution Control District, 2000a,b)

The Santa Barbara County Air Pollution Control District administers regulations for non-vehicular air pollution sources, and is required to monitor air pollutant levels to ensure Federal and state ambient air quality standards are met or develop a plan to meet them. (Air Force Center for Environmental Excellence, 1999). Air monitoring stations located on Vandenberg AFB include two Prevention of Significant Deterioration stations, the Vandenberg AFB Space Transport System and Vandenberg AFB Point Arguello (U.S. Department of the Air Force, 1995).

Prior Vandenberg AFB emissions inventory results show that missile launch emissions accounted for less than 1 percent of the total of PM-10 and 2.3 percent of the total of carbon monoxide. Since 1991, all new stationary sources of emissions (and modifications) at Vandenberg AFB have applied best available current technology and offset emissions at a 1.2 to 1.0 ratio. Therefore, current emissions at Vandenberg AFB, at least for stationary sources, are likely to be similar to the 1994 emissions inventory.

EnviroCom, used by Vandenberg AFB since 1996, is an air quality database used to track sources and inspections, monitor permits, and generate standardized emission reports (Air Force Center for Environmental Excellence, 1999).

Determination of Non-Applicability

Air quality impacts from previous target launches from Vandenberg AFB have been examined in previous EAs through a Determination of Non-Applicability and determined to be insignificant. Based on these results, the addition of a small amount of DF seedant would not cause or contribute to any new violation of any air quality standards in the region of influence. Further analysis of the additional seedant emission is provided in chapter 4.

3.2 BIOLOGICAL RESOURCES

Region of Influence

The ROI for biological resources includes the area within and adjacent to the proposed launch sites and MAB 1819 on Vandenberg AFB that could potentially be affected by the proposed activities.

Affected Environment

Vegetation

The launch facilities proposed for use are located in a grasslands community situated in Vandenberg's northernmost portions; LF-06, for instance, is only about 274 meters (900 feet) from the coast. The LF-06 site is located on a marine terrace in a remote, relatively flat grasslands area, where vegetation consists primarily of grasses and small herbs, such as sea rocket, sand verbena, heliotrope, and phacelia. (U.S. Department of the Air Force, 1991).

The area immediately adjoining the proposed launch sites is highly disturbed and supports ruderal vegetation consisting of mustards, wild oats, and veldt grass. Also present is a heavily impacted area of coastal dune scrub, dominated by giant ryegrass, deerweed, mock heather, and lupine. (U.S. Department of the Air Force, 1997)

The mouth of Shuman Canyon Creek, located 3.2 kilometers (2 miles) south of LF-06, is one of the northernmost on-base locations for the state-threatened surf thistle, in addition, the dune areas just north and south of the creek's mouth contain scattered populations. (California Polytechnic State University, Biological Sciences Department, 1995).

MAB 1819 is situated on the San Antonio Terrace, which is located within, and adjacent to, the largest expanse of stabilized sand dunes on Vandenberg AFB (U.S. Department of the Air Force, 1991). Swales (low areas), dune, grassland, and freshwater wetland are all found within this area. Representative plants include coastal lupine, mock heather, cudweed-aster, common phacelia, beach grass, veldt grass, seacliff buckwheat, and sticky monkey flower. (U.S. Department of the Air Force, 1997)

Wildlife

Vandenberg AFB plant communities provide habitat for many resident and migratory animals. The Western fence lizard, garter snake, brush rabbit, deer mouse, common crow, and mule deer are typical examples. Common wildlife species in the area also include pocket gophers, California ground squirrels, rabbit, and badger. Birds such as ring-billed, Heerman's, and glaucous-winged gulls, as well as western wood-pewee, rhinoceros auklets, red-winged blackbird, red-tailed hawk, great horned owl, and golden eagle have also been sighted. (U.S. Department of the Air Force, 1991; Vandenberg Air Force Base, 2000)

Because Vandenberg AFB is near the southern limit of the breeding ranges for many seabird species, in 1999, a long-term program began to annually monitor population dynamics and breeding biology of seabirds breeding on Vandenberg AFB; an estimated total of 1,200 seabirds were indicated that year. (Point Reyes Bird Observatory, 1999) The Pacific harbor seal is a resident species of Point Sal and Lion's Head. Other pinnipeds can be found in nearby haulout/rookery areas, preferring undisturbed sections of mainland coast and offshore islands or rocks.

The MAB 1819 area also supplies habitat for the Pacific tree frog, common yellowthroat, California and brush mouse, dusky-footed woodrat, and coyote. (U.S. Department of the Air Force, 1997)

Threatened and Endangered Species

Vandenberg AFB's diverse habitats support a wide variety of listed species. Those with the potential to occur within the ROI are shown in table 3-1.

The four known locations of Lompoc yerba santa (*Eriodictyon capitatum*), a Federal endangered plant species, occur in western Santa Barbara County. Two of these locations, composed of three groups, are on Vandenberg AFB. This plant is associated with the central maritime chaparral and bishop pine forest, which are threatened habitat types with limited distribution. (U.S. Environmental Protection Agency, 2001)

The Gaviota tarplant (*Hemizonia increscens* ssp. *Villosa*) has been listed by the U.S. Fish and Wildlife Service (USFWS) as endangered. It occurs within a narrow band of coastal terrace grassland between Gaviota and Santa Barbara (U.S. Environmental Protection Agency, 2001), southeast of LF-06 (Vandenberg Air Force Base, 2000).

The tidewater goby (*Eucyclogobius newberryi*), a Federal and California Department of Game and Fish endangered species, occurs in Shuman Canyon Creek. The California red-legged frog (*Rana aurora*), Federally proposed as endangered, is found in riparian wetland areas of northwestern Vandenberg AFB (U.S. Department of the Air Force, 1988). It prefers freshwater pools and ponds associated with arroyo willow, cattails, and other thickets of emergent aquatic vegetation (U.S. Department of the Air Force, 1995).

In March 2001, the USFWS designated 1.6 million hectares (4.1 million acres) in 28 California counties as critical habitat for the threatened California red-legged frog, but excluded Vandenberg AFB since its integrated natural resource management plan provided adequate management for the on-base population (Jumping Frog Research Institute, 2001).

San Antonio Creek, located south of MAB 1819, is one of the largest streams on base. Several freshwater marshes have been recorded along the San Antonio that, along with the creek itself and the lagoon at its mouth, are frequented by both common and rare Vandenberg species (U.S. Department of the Air Force, 1991); the unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), a Federal and state endangered fish, the tidewater goby, and the California red-legged frog can be found there. This may represent the northern limit for the stickleback (U.S. Department of the Air Force, 1992), which utilizes adjoining feeder streams during the wet season (Pacific Pipeline System, Inc., 1996)

Mod III Lake is located south of MAB 1819 on the southern edge of San Antonio Terrace. This man-made lake's fish, such as *gambusia*, are all introduced species. However, the California red-legged frog is located here (U.S. Department of the Air Force, 1988) and in surrounding riparian areas, as well as in freshwater ponds neighboring the area (Vandenberg Air Force Base, 1996) and Barka Slough (Christopher, 1995).

Table 3–1: Listed Species Known or Expected to Occur in the Vicinity of the Proposed Action

Scientific Name	Common Name	Status	
		State	Federal
Fish			
Eucyclogobius newberryi	Tidewater goby	E	E
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	E	E
Amphibians			
Rana aurora draytoni	California red-legged frog	CSC	T
Birds			
Brachyramphus marmoratus	Marbled murrelet	E	T
Charadrius alexandrinus nivosus	Western snowy plover	CSC	T
Pelecanus occidentalis californicus	California brown pelican	E	E
Sterna antillarum browni	California least tern	E	E
Mammals			
Enhydra lutris nereis	Southern sea otter	T	T
Plants			
Eriodictyon capitatum	Lompoc yerba santa	R	E
Hemizonia increscens ssp. *villosa*	Gaviota tarplant	E	E

Source: California Polytechnic State University, Biological Sciences Department, 1995; Chapman, 1996; Christopher, 1995; U.S. Department of the Air Force, 1991; Vandenberg Air Force Base, 1996; U.S. Fish and Wildlife Service, 2001.

NOTES:

CSC	California Species of Concern	R	Rare
E	Endangered	T	Threatened

Status Definitions

California Species of Concern—Native species or subspecies that have become vulnerable to extinction because of declining population levels, limited ranges, or rarity. The goal is to prevent these animals from becoming endangered by addressing the issues of concern early enough to secure long-term viability for these species.

Endangered—A native species or subspecies that is in serious danger of becoming extinct throughout all, or a significant portion, of its range.

Threatened—A native species or subspecies that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts.

Shuman Canyon Creek offers foraging areas for the state and Federally listed endangered California least tern (*Sterna antillarum brownii*). These seabirds preferentially forage in near-shore and coastal areas that have adequate supplies of prey fish (U.S. Department of the Air Force, 1992). Historically, the least tern has established nesting colonies in the area, as well as at Purisima Point, southwest of MAB 1819. The California brown pelican (*Pelecanus occidentalis californicus*), a Federal and state endangered subspecies, and the western snowy plover (*Charadrius alexandrinus nivosus*), a Federal threatened shorebird, are commonly observed in the Vandenberg area, which provides winter roosting for the former and nesting and roosting sites for the latter (U.S. Department of the Air Force, 1991). The pelicans roost at Point Sal and nesting plovers are located in coastal areas south of the proposed launch sites (figure 3-1). California brown pelicans and western

snowy plovers are also known to utilize areas within the vicinity of MAB 1819, particularly Purisima Point.

Vandenberg AFB supports over 20 percent of the California population of coastal western snowy plovers (Defense Environmental Network and Information eXchange, 2001b). Critical habitat for the snowy plover is located south of the Proposed Action locations, outside the ROI. Base officials and the USFWS have developed a management plan that protects western snowy plover nesting habitat on all of Vandenberg AFB beaches; establishes corridors that allow beach users access to lower beach areas without disturbing nesting plovers in the upper dunes; provides educational signs and public contact; and restricts off-road vehicle use on the beach to Air Force security patrols associated with rocket launches (U.S. Fish and Wildlife Service, 2001).

The recently Federally delisted and state endangered American peregrine falcon (*Falco peregrinus*) could potentially be located in the Point Sal area. This raptor has been the subject of an active state reintroduction program since the 1970s (U.S. Department of the Air Force, 1990), which has included on-base releases that undoubtedly account for the increase in on-base sightings in recent years (Santa Cruz Predatory Bird Research Group, 2001; Defense Environmental Network and Information eXchange, 2001b).

Environmentally Sensitive Habitat

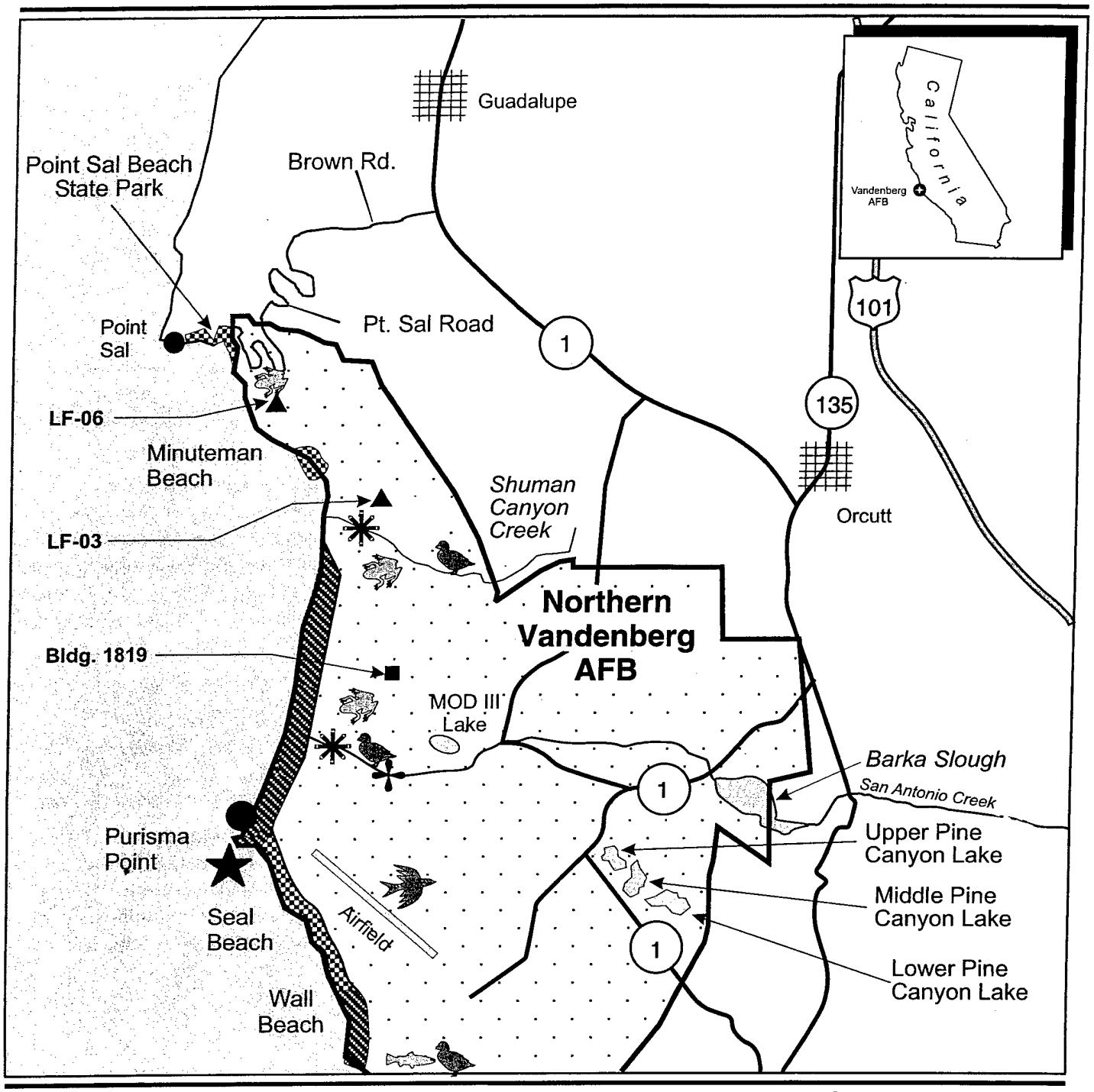
The installation envelops one of the major southern California dune systems, with areas still resembling their original condition, and occupies one of the state's six remaining coastal dune systems. Extensive central foredunes and coastal dune scrub are located on the North Vandenberg coast (U.S. Department of the Air Force, 1991).

Along with a network of swales, several wetlands (including two man-made) occur near MAB 1819; the closest is approximately 1.6 kilometers (1 mile) to the northwest. These wetlands, ranging between 0.8 and 2.8 hectares (2 and 7 acres) in size, support such typical species as arroyo willow, wide-leaf cattail, California bulrush, water smartweed, and bog rush.

3.3 HAZARDOUS MATERIALS AND HAZARDOUS WASTE

Several regulatory agencies (e.g., the U.S. EPA and the U.S. DOT have promulgated differing definitions of a hazardous material as applied to a specific situation. Of these definitions, the broadest and most applicable is the definition specified by the U.S. DOT for regulation of the transportation of these materials. As defined by the U.S. DOT, a hazardous material is a substance or material that is capable of posing an unreasonable risk to health, safety, or property when transported in commerce and has been so designated.

Waste materials are defined as any discarded material (i.e., abandoned, recycled, or "inherently waste-like") that is not specifically excluded. This waste can include



EXPLANATION

- Nesting Location of California Least Tern/ Western Snowy Plover
- Haulout Location of California Sea Lion, Northern Elephant Seal, and Pacific Harbor Seal
- Tidewater Goby
- Unarmored Threespined Stickleback
- Roosting Location of California Brown Pelican
- Southern Sea Otters
- California Least Tern Foraging Areas
- California Red-legged Frog (Wide Distribution Also Includes Ponds and Vernal Pools)
- Steelhead Trout
- Mountain Plover (Winters Only)

NORTH

Scale
0 2.4 4.8 kilometers
0 1.5 3 miles

10-23-01 Vandenberg Habitat

Sensitive Habitat for Listed Wildlife Species on Vandenberg AFB

Western Range Candidate Test Area

Figure 3-1

materials that are both solid and liquid (but contained). Hazardous waste is further defined as any solid waste not specifically excluded, which meets specified concentrations of chemical constituents or has certain toxicity, ignitability, corrosivity, or reactivity characteristics.

The State of California has assumed responsibility for regulation of all activities previously regulated by the U.S. EPA. California has adopted the requirements found in the Federal regulations, which are rewritten in Title 22 of the California Code of Regulations.

Region of Influence

The ROI for potential impacts related to hazardous materials/wastes would be limited to areas of the base to be used for launch activities, prelaunch site preparation, and in areas where seedant and HE would be stored and handled.

Affected Environment

Hazardous Materials Activities

Due to the diversity in missions performed at Vandenberg AFB, a wide variety of hazardous material types and quantities are in use. Their utilization must conform to Federal, DoD, and Air Force hazardous materials management requirements. Hazardous materials are tracked by EnTrack® System personnel within Vandenberg's Logistic Group (Chapman, 1996). Such materials fall into two basic use categories: materials used in facility maintenance activities and those used in various missile test operations.

The utilization of all hazardous materials is subject to ongoing inspection by Vandenberg personnel to ensure safe handling (Chapman, 1997). The majority of these materials are consumed in operational processes, leaving the remainder to be collected as hazardous waste.

Typical hazardous materials used in base infrastructure support include various cleaning solvents (chlorinated and non-chlorinated) and fluids, paints, pesticides, and motor fuels and other petroleum products. These materials arrive at Vandenberg via typical freight delivery routes (truck, rail, air), after which they may be issued to individual users through the facility supply system. These users provide storage of all materials in accordance with established procedures applicable to individual operations.

Prior to each launch or space booster fueling operation, Vandenberg AFB computes a toxic hazard corridor to ensure surrounding communities are not at risk in the event of an anomaly. Only when meteorological conditions indicate the toxic hazard corridor does not extend off the base is the operation allowed to proceed.

Range testing operations, such as missile launches, also employ a wide variety of hazardous materials. Cleaning solvents (chlorinated and non-chlorinated) and freons, various painting compounds, explosive materials, and toxic propellants are typical examples, though their types and quantities vary depending upon specific system and test-

configuration requirements. Hazardous materials used in conjunction with these programs are brought on base by the agency responsible for testing the individual systems. Each agency utilizing Vandenberg AFB is responsible for procurement, distribution, and management of its hazardous materials, which must conform to the requirements of Vandenberg AFB hazardous waste management procedures.

Hazardous Waste Activities

Vandenberg AFB regulations, particularly the *Hazardous Waste Management Plan* (dated 15 November 2000), specify all procedures for packaging, handling, transporting, and disposing of hazardous waste (Chapman, 1996). Hazardous wastes generated during Vandenberg AFB activities are initially collected at the point of generation and, if not reused or recycled, transported to the collection-accumulation point (CAP) managed by the base Environmental Compliance Programs Office in Civil Engineering. Here it is containerized and segregated by type. (Chapman, 1997) Following initial containerization, waste may remain at the CAP for up to 90 days, at which point all hazardous waste must be transported to the off-site Treatment, Storage, and Disposal Facility (Vandenberg Air Force Base, 2001).

3.4 HEALTH AND SAFETY

Health and safety includes consideration of any activities, occurrences, or operations that have the potential to affect one or more of the following:

The well-being, safety, or health of workers—Workers are considered to be persons directly involved with the operation producing the effect or who are physically present at the operational site.

The well-being, safety, or health of members of the public—Members of the public are considered to be persons not physically present at the location of the operation, including workers at nearby locations who are not involved in the operation and the off-base population. Also included within this category are hazards to equipment, structures, flora, and fauna.

Region of Influence

The ROI for health and safety of workers includes the immediate work areas, the launch site, and the flight corridor. The ROI for public safety includes the above and any bordering areas that may be affected by proposed activities.

Affected Environment

Vandenberg AFB is involved in the ongoing test and evaluation of various missiles, with safe procedural practices as a primary objective. To accomplish this, an aggressive safety evaluation and control system has been implemented, based on more than 40 years experience in test and evaluation.

Proposed on-base program operations must receive prior approval, accomplished by the user through presentation of the program to Space Wing/Safety Office (30 SW/SE). All safety analyses, standard operating procedures, and other safety documentation applicable to those operations affecting Vandenberg AFB or the Western Range Area and its controlled range space must be provided, along with an overview of mission objectives, support requirements, and schedule. The 30 SW/SE evaluates this information, ensuring that all Western Range Area safety requirements are met.

Preceding operations that may involve ground impact of objects within the range, an evaluation is made to ensure that populated areas, critical range assets, and civilian property susceptible to damage are outside predicted impacts limits. A Notice to Mariners and a Notice to Airmen are published and circulated in accordance with established procedures to provide warning to personnel (including recreational users of the range space and controlled sea areas) concerning any potential impact areas that should be avoided. Radar and visual sweeps of hazard areas are accomplished immediately prior to operations to ensure evacuation of non-critical personnel. Prior to missile flight operations, the performance of all target missiles is evaluated by 30 SW/SE.

Vandenberg AFB possesses significant emergency response capabilities that include its own Fire Department, Disaster Control Group, and Security Police Force, in addition to contracted support for handling accidental releases of regulated, hypergolic propellants and other hazardous substances. The Readiness Flight (30 CES/CEX) manages the overall base emergency response program and is responsible for developing and updating the Vandenberg AFB Hazardous Material Emergency Response Plan. Additionally, the Readiness Flight chairs the Hazardous Materials Planning Team, ensures that follow-on elements of the Disaster Control Group are assembled as required by the On-Scene Commander in the event of a release response, and maintains training certificates for spill response team members. (Vandenberg Air Force Base, 1999)

According to the Santa Barbara County Integrated Hazardous Materials Management System Operation Agreement, the base Fire Department approves and maintains the business plans and hazardous material inventories prescribed by the California Health and Safety Code, which are developed by organizations assigned to or doing business on the base. This information can be retrieved electronically in the event of an emergency. Additionally, the base Fire Department conducts onsite facility inspections, as required, to identify potentially hazardous conditions that could lead to an accidental release. It should be noted that the Vandenberg AFB Fire Department is advised of all operations involving the transfer of hypergolic propellants on the base. During launch operations, Fire Department response elements are pre-positioned to expedite response in the event of an anomaly. (Vandenberg Air Force Base, 1999)

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4.0
ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental consequences of the proposed activities by comparing these activities with the potentially affected environmental components. Sections 4.1 through 4.4 provide discussions of the potential environmental consequences of these activities. Potential impacts are discussed in terms of seedant and payload transportation, seedant integration, flight testing, and cumulative impacts. The amount of detail presented in each section is proportional to the potential for impacts. Sections 4.5 through 4.13 provide discussions of the following with regard to proposed program activities: environmental effects of the No-action Alternative; adverse environmental effects that cannot be avoided; conflicts with Federal, state, and local land use plans, policies, and controls for the area concerned; energy requirements and conservation potential; irreversible or irretrievable commitment of resources; relationship between short-term use of the human environment and the maintenance and enhancement of long-term productivity; natural or depletable resource requirements and conservation potential; Executive Order 13045, *Federal Actions to Address Protection of Children from Environmental Health Risks and Safety Risks,* and Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations.*

To assess the potential for and significance of environmental impacts from the proposed program activities, a list of activities was developed (chapter 2.0) and the environmental setting was described, with emphasis on any special environmental sensitivities (chapter 3.0). Program activities were then compared with the potentially affected environmental components to determine the environmental impacts of the proposed LFT&E activities.

To help define the affected environment and determine the significance of program-related effects, written, personal, and telephone contacts were made with applicable agencies and installations. Section 7 provides a list of those contacted.

4.1 PROPOSED ACTION

4.1.1 AIR QUALITY

Santa Barbara County is in attainment for all air quality standards except the Federal and state ozone standards, and the state standard for PM-10. The Proposed Action would not substantially impact the regional air quality unless the estimate of total operation emissions of the project exceeds current air quality standards within the Santa Barbara Air Basin. Previous target emissions analysis from Vandenberg showed insignificant impacts to air quality in the region. A successful flight test using a target missile with the DF seedant and the HE would also have negligible air quality impacts as explained in greater detail below. In the case of a ground-level accident, levels of emissions from the kill vehicle and payload would not exceed the current air quality standards due to the small amount of

seedant in the payload. Vandenberg AFB complies with the Santa Barbara County Air Pollution Control District rules and regulations listed below. The Proposed Action would comply with these and any other applicable rules.

- Rule 317, Organic Solvents, provides limits to any solvent materials used in the project.
- Rule 323, Architectural Coatings, provides for coating materials applied to an architectural structure.
- Rule 330, Surface Coating of Metal Parts and Products, applies if metal parts are coated on base prior to construction.
- Rule 353, Adhesives and Sealants, applies if adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, or any other primers are used during the project unless specifically exempted by this rule.
- Only California Air Resources Board-certified blasting medium would be permitted if abrasive blasting were used.
- Any portable equipment powered by an internal combustion engine of 20 British horsepower or higher used in this project must be registered in the California State-wide Portable Equipment Registration Program or have a valid Santa Barbara County Air Pollution Control District Permit to Operate. (Vandenberg Air Force Base, 2001)

DF Seedant Analysis

A vessel of seedant chemical would be loaded as part of the target payload into the RV. Upon impact, the vessel would be breached, releasing approximately 2 kilograms (4 pounds) (2 liters [0.5 gallon]) of chemical into the upper atmosphere, where the Remote Optical Characterization Sensor Suite instruments would detect it.

In flight from Vandenberg AFB to Kwajalein, the target missile third stage produces 332 kilograms (732 pounds) of HCl as it climbs from about 125 to 300 kilometers (78 to 186 miles). The extra HCl from the seedant release corresponds to 0.3% of that produced by the target launch vehicle and therefore should have negligible impact.

DF released at altitudes of 200 to 250 kilometers (124 to 155 miles) would slowly dissociate, but not cause ozone depletion. All emissions would be regulated in accordance with the Memorandum of Agreement between Vandenberg AFB and the Santa Barbara County Air Pollution Control District and impacts to air quality in the region are not expected to be substantial (U.S. Department of the Air Force, 1997).

Cumulative Impacts

Missile launches are short-term, discrete events, thus allowing time between launches for emission products to be dispersed. The addition of various combinations of seedant compound and HE material to the RVs of target missiles would not substantially add to the amount of emissions produced during launch or intercept and is not expected to result in cumulative impacts to air quality.

4.1.2 BIOLOGICAL RESOURCES

The Natural Resources section of the 30 Civil Engineering Squadron/Environmental Management (30 CES/CEVPN) provides review and oversight for natural resource issues pertaining to base programs and projects. Responsibilities include rare species inventories, sensitive habitat protection, maintenance of Geographic Information System databases of rare and listed species, and endangered and threatened species monitoring, management and protection.

Vegetation

No construction would be required as part of proposed LFT&E activities, thus there would be no ground disturbance and resultant impact to vegetation. All applicable U.S. Air Force, U.S. DOT, and U.S. Army safety regulations, and Occupational Safety and Health Administration requirements would be followed which would minimize the potential for accidental spills, as well as provide the means for mitigating or minimizing effects to vegetation if an accident were to occur. No adverse impacts are anticipated to vegetation including the Gaviota tarplant and Lompoc yerba santa as a result of proposed activities.

Wildlife

Seedant filling operations would occur in MAB 1819 or potentially on the launch pad. In a 1934 study on the toxicity effects of HF (Chemical properties and environmental and safety hazards of HF and DF are equivalent) on animals, no deaths occurred in animals exposed to 1,200 ppm HF for 30 minutes (American Industrial Hygiene Association, 1988). Concentrations below 120 ppm were tolerated for 5 hours with no deaths by rabbits and guinea pigs (American Industrial Hygiene Association, 1988). Accidental release of hazardous material due to seedant filling would be limited to a few ounces of DF, which would be contained in MAB 1819 or dispersed before reaching the edge of the launch pad. No adverse effects to wildlife species such as the California brown pelican and the California least tern, including airborne risks, are expected as a result of this limited level of DF emissions.

DF would be stored in MAB 1819. In the unlikely event of an accidental release of stored DF, the Proposed Action would comply with Vandenberg AFB's Risk Management Plan in order to prevent impacts to biological resources in the vicinity. All applicable U.S. Air Force, DOT, and Army safety regulations, and Occupational Safety and Health Administration requirements would be followed which would also minimize the potential for accidental spills, as well as provide the means for mitigating or minimizing effects to wildlife if an accident were to occur. No impacts to wildlife, including listed species, are expected as a result of accidental release of DF.

Intercept would occur over the Broad Ocean Area of the Pacific Ocean (figure 1-2) at an altitude of approximately 200 kilometers (124 miles). The seedant would be excited by the energy resulting from the high-velocity impact and would be released into the vacuum of space as the vessel ruptures. DF released at this altitude will slowly dissociate and would not increase the potential for impacts to marine species. If the interceptor fails to hit the target, the RV would continue on a ballistic trajectory and fall into the Pacific Broad

Ocean Area. The seedant material would either be vaporized with HE detonation upon impact, or the RV and seedant vessel would rupture upon impact and the seedant would be dispersed into the ocean. The small amount (2 kilograms [4 pounds]) (2 liters [0.5 gallon]) of DF that could disperse is expected to result in a negligible increase in the potential for impact to marine species that could be within the area.

RDX is used as an explosive and in combination with other ingredients in explosives. RDX can be broken down in water in a few hours, more slowly in soils. RDX has a very low vapor pressure; therefore, air emissions and effects are considered negligible. It has a very low solubility in water that tends to limit downward mobility in soil-water systems. (Chemical Propulsion Information Agency, 1984) RDX has not been shown to build up in fish (U.S. Department of Commerce, 1995). No adverse impacts to listed aquatic species are anticipated.

Environmentally Sensitive Habitat

No adverse impacts to the coastal dune systems are anticipated. Accidental release of seedant during filling operations or while stored would be contained in MAB 1819 or dispersed before reaching the edge of the launch pad. No adverse impacts to wetlands are expected.

Cumulative Impacts

No cumulative impacts to biological resources are expected as a result of seedant transport or filling operations. Accidental releases or spills would be limited to only a few ounces that would be contained or dispersed prior to reaching sensitive vegetation or wildlife. The small amount of DF that could be dispersed during launch and intercept is not expected to result in an increased potential for cumulative impact to marine species.

4.1.3 HAZARDOUS MATERIAL AND WASTE

Hazardous materials used and hazardous waste currently generated during operations at Vandenberg AFB include solvents and cleaners, paints and primers, small amounts of hypergol-contaminated water, adhesive, alcohol, lubricant, propellant, and contaminated rags. LFT&E launch operations would involve similar types of hazardous materials and the resulting waste would be containerized and disposed of or recycled in accordance with Vandenberg AFB procedures. Hazardous waste generated would be managed in compliance with Resource Conservation and Recovery Act, DoD, and other applicable Federal, state, and local regulations. No additional impacts from these types of hazardous wastes are anticipated as a result of LFT&E activities.

The primary hazardous materials associated with the LFT&E program are DF and HE. As discussed in section 2.2, only enough seedant for two missile flights (4 liters [1 gallon]) would be shipped to Vandenberg AFB at one time. The seedant and 11 to 44 kilograms (25 to 100 pounds) of Comp-B would be stored in their original sealed shipping containers in an approved storage facility. According to the Material Safety Data Sheet (appendix B), decomposition of the DF will not occur if properly stored. No dangerous reactions

between DF and other chemicals are known to exist. DF does not present an explosive hazard. Comp-B is a hazardous material commonly used in missiles and rockets.

Cumulative Impacts

Adherence to the hazardous materials and waste management systems on Vandenberg AFB would preclude any impacts due to accumulation in the environment as a result of routine usage. The base has implemented an emergency response procedure that would aid in the evaluation and cleanup of any hazardous materials released. The Proposed Action is not expected to result in cumulative hazardous materials and waste impacts.

4.1.4 HEALTH AND SAFETY

Potential impacts to health and safety could result from accidents during transportation of the seedant and HE to, and on, Vandenberg AFB. However, Federal Aviation Administration, applicable U.S. Air Force, DOT, and Army safety regulations, and Occupational Safety and Health Administration requirements would be followed which would minimize the potential for accidents, as well as provide the means for mitigating adverse effects if an accident were to occur. No effects to the public are anticipated.

DF is very toxic through inhalation, skin contact, and swallowing. It is classified as a corrosive and can cause severe burns. As discussed in section 2.3, all seedant-loading procedures would be reviewed and approved by the Vandenberg AFB Safety Office prior to filling operations. The usual precautionary measures for handling chemicals would be followed. All personnel involved in filling operations would wear appropriate protective clothing including impervious gloves, suitable respirators, and eye protection. Personnel would be trained in the correct procedures for handling DF and HE.

Cumulative Impacts

The addition of small amounts of DF and HE proposed for use would result in a small increase in potential safety risk. However, since all applicable regulations would be followed during transport and filling and launch operations, no cumulative health and safety impacts are anticipated.

4.2 HYDROGEN FLUORIDE SEEDANT ALTERNATIVE

Since the chemical properties and environmental and safety hazards of HF and DF are equivalent, the analysis provided in section 4.1 is also applicable to this alternative.

4.3 CHEMICAL MIXTURE SEEDANT ALTERNATIVE

In additional to DF and HF, seedant alternatives include HCl (^{35}HCl and ^{37}HCl), HBr, HDO, and D_2O. The addition of HCl to the target payload would not result in a substantial increase in the impacts previously analyzed for solid propellant missiles. HBr would present potential hazards similar to HCl. Vapors are irritating and corrosive and contact with gas may cause burns. Neither ignites readily. The potential for impacts to humans, vegetation, and wildlife would be similar to those discussed for the Proposed Action. No substantial adverse impacts would be expected.

Deuterium is an isotope of hydrogen with one extra neutron. D_2O is chemically the same as regular water. D_2O and HDO pose little risk of releasing hazardous substances into the environment. They are not radioactive or dangerous to humans or other life in the quantities that would be required for the LFT&E program.

Due to the difference in characteristics such as vapor pressure and corrosion, unique filling operations would be written and approved if and when alternative seedants are selected. Fill system hardware changes may also be required (relief valve, pump, vessel, regulator). Transportation of the alternative seedants would be the same as that discussed for the use of DF.

4.4 OMIT HIGH EXPLOSIVE ALTERNATIVE

If no HE is included in the payload, additional DF seedant may be flown to improve the probability of detection. Adding up to 10 liters (2.6 gallons) of DF while eliminating the 44 kilograms (100 pounds) of HE would not result in a substantial increase in impacts. The analysis provided in section 4.1 is also applicable to this alternative.

4.5 ENVIRONMENTAL EFFECTS OF THE NO-ACTION ALTERNATIVE

If the No-action Alternative is selected, no environmental consequences associated with the LFT&E program are anticipated. Present activities would continue with data telemetered from on-board instrumentation as the only source of information for determining lethality of intercepts. The capability to provide additional lethality data to supplement the telemetry data would not be further developed or tested. In the event of limited or insufficient telemetry data, use of the seedant would not be available to provide the only confirmation of interceptor effectiveness. Vandenberg AFB would continue to launch target missiles as analyzed in prior EAs such as the Theater Ballistic Missile Targets Programmatic EA (U.S. Department of the Air Force, 1997) and the EA for Air Force Small Launch Vehicle (U.S. Department of the Air Force, 1991).

4.6 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

Adverse environmental effects that cannot be avoided include the release of small amounts of pollutants into the atmosphere and ocean, and minor increased generation of hazardous materials at program-related sites. Any hazardous waste generated would be managed in compliance with Resource Conservation and Recovery Act, DoD, and other applicable Federal, state, and local, regulations.

4.7 CONFLICTS WITH FEDERAL, STATE, AND LOCAL LAND USE PLANS, POLICIES, AND CONTROLS FOR THE AREA CONCERNED

All of the proposed program activities would take place in existing facilities and locations. These activities would not alter the uses of the sites, which were in the past or currently are used to support missile and rocket testing. There are no known conflicts with land use plans, policies, and controls at Vandenberg AFB.

4.8 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Anticipated energy requirements of the LFT&E program would be well within the energy supply capacity of all facilities. Use of seedant and HE would not substantially increase energy requirements.

4.9 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

The Proposed Action would result in no loss of habitat for plants or animals, no loss of or impact on threatened or endangered species, and no loss of cultural resources, such as archaeological or historic sites. Moreover, there would be no changes in land use or preclusion of development of underground mineral resources that were not already constrained.

The amount of materials required for any program-related activities and energy used during the project would be small. Although the proposed activities would result in some irreversible or irretrievable commitment of resources such as various metallic materials, minerals, and labor, this commitment of resources is not significantly different from that necessary for many other defense research and development programs carried out over the past several years. Proposed activities would not commit natural resources in significant quantities.

4.10 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Proposed LFT&E program activities would take advantage of existing facilities and infrastructure. The uses of the sites, which were or are to support missile and rocket launches, would not be altered. Therefore, the Proposed Action does not eliminate any options for future use of the environment for the locations under consideration.

4.11 NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL

Other than various structural materials and fuels, no significant natural or depletable resources would be required by the program.

4.12 FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS (EXECUTIVE ORDER 12898)

LFT&E program activities would be conducted in a manner that would not substantially affect human health and the environment. The EA has identified no effects that would result in disproportionately high or adverse effect on minority or low-income populations in the area. The activities would also be conducted in a manner that would not exclude persons from participating in, deny persons the benefits of, or subject persons to discrimination under the LFT&E program because of their race, color, national origin, or socioeconomic status.

4.13 FEDERAL ACTIONS TO ADDRESS PROTECTION OF CHILDREN FROM ENVIRONMENTAL HEALTH RISKS AND SAFETY RISKS (EXECUTIVE ORDER 13045)

This EA has not identified any environmental health and safety risks that may disproportionately affect children, in compliance with Executive Order 13045.

5.0
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7.0
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GC

Ballistic Missile Targets Joint Project Office
TTPO

Lawrence Livermore National Laboratory

Sandia National Laboratories

Vandenberg AFB
30 CES/CSV

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APPENDIX A
DISTRIBUTION LIST

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DISTRIBUTION LIST

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Huntsville, Alabama

Vandenberg AFB
30 CES/CEV

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APPENDIX B
MATERIAL SAFETY DATA SHEET

APPENDIX B
MATERIAL SAFETY DATA SHEET

Material Safety Data Sheet
acc. to OSHA and ANSI

Printing date 10/10/2000 Reviewed on 06/08/2000

1 Identification of substance:

Product details:

Trade name: Deuterium fluoride

Stock number: 45079

Manufacturer/Supplier:
Alfa Aesar, A Johnson Matthey Company
Johnson Matthey Catalog Company, Inc.
30 Bond Street
Ward Hill, MA 01835-8099
Emergency Phone: (978) 521-6300
CHEMTREC: (800) 424-9300
Web Site: www.alfa.com

Information department: Health, Safety and Environmental Department
Emergency information:
During normal hours the Health, Safety and Environmental Department.
After normal hours call Chemtrec at (800) 424-9300.

2 Composition/Data on components:

Chemical characterization:
Description: (CAS#)
Deuterium fluoride (CAS# 14333-25-6), 100%
Identification number(s):
EU Number: 009-003-00-1

3 Hazards identification

Hazard description:

T+ Very toxic
C Corrosive

Information pertaining to particular dangers for man and environment
R 26/27/28 Very toxic by inhalation, in contact with skin and if swallowed.
R 35 Causes severe burns.

4 First aid measures

General information
Immediately remove any clothing soiled by the product.
Remove breathing apparatus only after contaminated clothing has been completely removed.
In case of irregular breathing or respiratory arrest provide artificial respiration.
After inhalation
Supply fresh air. If required, provide artificial respiration. Keep patient warm.
Seek immediate medical advice.

(Contd. on page 2)

Trade name: Deuterium fluoride

(Contd. of page 1)

After skin contact
Immediately wash with water and soap and rinse thoroughly.
Seek immediate medical advice.
Rub in calcium gluconate solution or calcium gluconate gel immediately.
After eye contact
Rinse opened eye for several minutes under running water. Then consult a doctor.
After swallowing
Do not induce vomiting; immediately call for medical help.
Seek immediate medical advice.

5 Fire fighting measures

Suitable extinguishing agents
Product is not flammable. Use fire fighting measures that suit the surrounding fire.
Special hazards caused by the material, its products of combustion or resulting gases:
Hydrogen gas may accumulate in metal storage containers.
Protective equipment:
Wear self-contained respirator.
Wear fully protective impervious suit.

6 Accidental release measures

Person-related safety precautions:
Wear protective equipment. Keep unprotected persons away.
Ensure adequate ventilation
Measures for environmental protection:
Do not allow material to be released to the environment without proper governmental permits.
Measures for cleaning/collecting: Ensure adequate ventilation.
Additional information:
See Section 7 for information on safe handling
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

Handling
Information for safe handling:
Keep container tightly sealed.
Store in cool, dry place in tightly closed containers.
Ensure good ventilation at the workplace.
Open and handle container with care.
Information about protection against explosions and fires:
The product is not flammable

Storage
Requirements to be met by storerooms and receptacles:
No special requirements.
Information about storage in one common storage facility:
Do not store together with acids.
Do not store together with alkalies (caustic solutions).

(Contd. on page 3)

Trade name: Deuterium fluoride

(Contd. of page 2)

Further information about storage conditions:
Keep container tightly sealed.
Store in cool, dry conditions in well sealed containers.
Store under lock and key and with access restricted to technical experts or their assistants only.

8 Exposure controls and personal protection

Additional information about design of technical systems:
Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.

Components with limit values that require monitoring at the workplace:

Hydrogen fluoride (as F)

	ppm
ACGIH TLV	3 Ceiling
Belgium TWA	3 STEL
France TWA	3 STEL
Germany TWA	3
Netherlands TWA	3.3 STEL
Switzerland TWA	1.6, 3.6 STEL
United Kingdom TWA	3 STEL
Russia TWA	3, 0.5 mg/m3 STEL
Denmark	2
Finland	6 (skin) STEL
Hungary TWA	0.5 mg/m3, 1 mg/m3 STEL
Poland TWA	0.5 mg/m3
Ireland	3 STEL
Sweden	2 STEL
USA PEL	3

Additional information: No data

Personal protective equipment
General protective and hygienic measures
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Remove all soiled and contaminated clothing immediately.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes and skin.
Breathing equipment:
Use suitable respirator when high concentrations are present.
Protection of hands: Impervious gloves
Eye protection:
Safety glasses
Tightly sealed goggles
Full face protection
Body protection: Protective work clothing.

9 Physical and chemical properties:

Form: Gaseous
Color: Colorless

(Contd. on page 4)

Trade name: Deuterium fluoride

(Contd. of page 3)

Odor: Not determined

	Value/Range	Unit	Method
Change in condition			
Melting point/Melting range:	Not determined		
Boiling point/Boiling range:	Not determined		
Sublimation temperature / start:	Not determined		
Flash point:	Not applicable		
Ignition temperature:	Not determined		
Decomposition temperature:	Not determined		

Danger of explosion:
Product does not present an explosion hazard.

Explosion limits:			
Lower:	Not determined		
Upper:	Not determined		
Vapor pressure:	Not determined		
Density: at 20 ° C	1.0	g/cm³	
Solubility in / Miscibility with Water:	Fully miscible		

10 Stability and reactivity

Thermal decomposition / conditions to be avoided:
Decomposition will not occur if used and stored according to specifications.
Materials to be avoided:
Acids
Bases
Dangerous reactions No dangerous reactions known
Dangerous products of decomposition: Hydrogen

11 Toxicological information

Acute toxicity:
LD/LC50 values that are relevant for classification:
INH-HMN LCLo: 50 ppm/30M (HF)
IHL-RAT LC50: 1276 ppm/1H (HF)
IHL-MUS LC50: 342 ppm/1H (HF)
INH-MKY LC50: 1774 ppm/1H (HF)
INH-GPG LC50: 4327 ppm/15M (HF)
Primary irritant effect:
on the skin:
Strong corrosive effect on skin and mucous membranes.
Irritant to skin and mucous membranes.
on the eye:
Strong corrosive effect.
Irritating effect.
Sensitization: No sensitizing effects known.

(Contd. on page 5)

Trade name. Deuterium fluoride

(Contd. of page 4)

Other information (about experimental toxicology):
Mutagenic effects have been observed on tests with laboratory animals.
Reproductive effects have been observed on tests with laboratory animals.
Subacute to chronic toxicity:
Hydrofluoric acid is extremely irritating and corrosive. It is destructive of tissues it comes in contact with, either as a vapor or as a liquid. Skin burns caused by hydrofluoric acid may appear to be stable only to get much worse several hours after exposure. Skin contact with hydrofluoric acid has led to industrial fatalities. Dilute solutions have a reduced effect.
Subacute to chronic toxicity:
Corrosive materials are acutely destructive to the respiratory tract, eyes, skin and digestive tract. Eye contact may result in permanent damage and complete vision loss. Inhalation may result in respiratory effects such as inflammation, edema, and chemical pneumonitis. May cause coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting. Ingestion may cause damage to the mouth, throat and esophagus. May cause skin burns or irritation depending on the severity of the exposure.
Additional toxicological information:
Danger through skin absorption.
Swallowing will lead to a strong corrosive effect on mouth and throat and to the danger of perforation of esophagus and stomach.
To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.
No classification data on carcinogenic properties of this material is available from the EPA, IARC, NTP, OSHA or ACGIH.

12 Ecological information:

General notes:
Do not allow material to be released to the environment without proper governmental permits.

13 Disposal considerations

Product:
Recommendation
Consult state, local or national regulations for proper disposal.

Uncleaned packagings:
Recommendation:
Disposal must be made according to official regulations.
Recommended cleansing agent: Water, if necessary with cleansing agents.

14 Transport information

DOT regulations:
Hazard class: 8
Identification number: UN1052
Packing group: I
Proper shipping name (technical name):
Hydrogen fluoride, anhydrous

Land transport ADR/RID (cross-border)

(Contd. on page 6)

Trade name: Deuterium fluoride

(Contd. of page 5)

ADR/RID class: 8
Item: 6
Danger code (Kemler): 886
UN-Number: 1052
Description of goods: Hydrogen fluoride, anhydrous

Maritime transport IMDG:
IMDG Class: 8
UN Number: 1052
Packaging group: I
Proper shipping name: Hydrogen fluoride, anhydrous

Air transport ICAO-TI and IATA-DGR:
ICAO/IATA Class: 8
UN/ID Number: 1052
Packaging group: I
Proper shipping name: Hydrogen fluoride, anhydrous

15 Regulations

Product related hazard informations:

Hazard symbols:
T+ Very toxic
C Corrosive

Risk phrases:
26/27/28 Very toxic by inhalation, in contact with skin and if swallowed.
35 Causes severe burns.

Safety phrases:
7/9 Keep container tightly closed and in a well-ventilated place.
26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
36/37 Wear suitable protective clothing and gloves.
45 In case of accident or if you feel unwell, seek medical advice immediately.

National regulations
This product is not listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical Substance Inventory. Use of this product is restricted to research and development only.

Information about limitation of use:
For use only by technically qualified individuals.

16 Other information:

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

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Material Safety Data Sheet
acc. to OSHA and ANSI

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Trade name: Deuterium fluoride

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Department issuing MSDS: Health, Safety and Environmental Department.
Contact: Darrell R. Sanders

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